IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re U.S. Patent Application of	)	
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SUZUKI et al.	)	**Art Unit 2186**
	)	
Application Number: 10/766,187	)	
	)	
Filed: January 29, 2004	)	
	)	
For: DISK ARRAY DEVICE AND REMOTE COPYING CONTROL METHOD FOR DISK ARRAY DEVICE	)	
	)	
Attorney Docket No. WILL.0002	)	

Honorable Assistant Commissioner for Patents
Washington, D.C. 20231

PETITION TO MAKE SPECIAL UNDER 37 C.F.R. § 1.102(d)

FOR ACCELERATED EXAMINATION

Sir:

Pursuant to 37 C.F.R. § 1.102(d), Applicant respectively requests that the application be examined on the merits in conjunction with the pre-examination search results, the detailed discussion of the relevance of the results and amendments as filed concurrently.

Substantive consideration of the claims is respectfully solicited. Should there be any outstanding issues requiring discussion that would further the prosecution and allowance of the above-captioned application, the Examiner is invited to contact the Applicant's undersigned representative at the address and telephone number indicated below.

Respectfully submitted,

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STATEMENTS & PRE-EXAMINATION SEARCH REPORT SUPPLEMENTAL TO THE PETITION TO MAKE SPECIAL

Sir:

Pursuant to 37 C.F.R. §§ 1.102 and MPEP 708.02 VIII, Applicant hereby submits that (1) all claims of record are directed to a single invention, or if the Office determines that all the claims presented are not obviously directed to a single invention, will make an election without traverse as a prerequisite to the grant of special status; (2) a pre-examination search has been conducted according to the following field of search; (3) copies of each reference deemed most closely related to the subject matter encompassed by the claims are enclosed; and (4) a detailed discussion of the references pointing out how the claimed subject matter is patentable over the references is also enclosed herewith.

FIELD OF THE SEARCH

The field of search includes the following classes:

Class	Subclasses	Description
709/		**ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MULTICOMPUTER DATA TRANSFERRING OR PLURAL PROCESSOR SYNCHRONIZATION**
	229	.. Network resources access controlling
	232	.. Computer-to-computer data transfer regulating
	233	... Transfer speed regulating
710/		**ELECTRICAL COMPUTERS AND DIGITAL DATA PROCESSING SYSTEMS: INPUT/OUTPUT**
	34	.. Transferred data counting
	60	.. Transfer rate regulation
711/		**ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MEMORY**
	100	STORAGE ACCESSING AND CONTROL
	112	... Direct access storage device (DASD)
	152	.. Memory access blocking
	167	. Access timing

The above subclasses represent areas deemed to contain subject matter of interest to one or more of the search features. The integrity of the search is based on the records as presented to us by the United States Patent and Trademark Office (USPTO). Also a key word search was performed on the USPTO full-text database including published U.S. patent applications.

The search was directed towards claims 1-14 of U.S. Application 10/766,187. The claims are generally characterized by a disk array device comprising: a channel adapter connected to a host device and external device via a communications port for controlling the exchange of data with the host device and external device; a disk adapter for controlling the exchange of data with a memory device; a cache memory used by said channel adapter and disk adapter; one or more logical system partitions which are constructed by logically dividing the resources provided by said channel adapter, disk adapter, memory device, and cache memory; a transfer amount detection part which detects the amount of data transferred to said external device from said logical system partitions for each of said logical system

partitions; and a data transfer control part which compares a specified value that is preset for each of said logical system partitions and the data transfer amount detected by said transfer amount detection part, and performs band control that limits the transfer of data from said logical system partitions to said external devices in cases where the data transfer amount exceeds said specified value. The invention performs a plurality of data transfer operations in an efficient manner using limited communications resources (See Conclusion paragraph for detailed references to drawings and specification).

LIST OF RELEVANT REFERENCES

The search revealed the following U.S. patents, which are listed for convenience:

U.S. Patent No.	Inventor
6,324,654 B1	**Wahl et al.**
6,625,623 B1	**Midgley et al.**

U.S. Patent Application Publication No.	Inventor
2003/0061362 A1	**Qiu et al.**
2004/0010605 A1	**Furukawa et al.**
2004/0181594 A1	**Suleiman**

Discussion of References:

U.S. Patent No. 6,324,654 B1 to **Wahl** et al. is assigned to Legato Systems, Inc. and is entitled "Computer Network Remote Data Mirroring System." **Wahl**'s computer network remote data mirroring system 10 (Fig. 1) provides network bandwidth throttling. Throttles is defined as user tests or actions evaluated by a primary mirror daemon 24, in order to limit the system and the network resource consumption by data mirroring 10 (col. 14, lines 36-37). Bandwidth throttling enables a predetermined portion of the bandwidth of a network 20 to be assigned to remote data mirroring depending on the time of day or other criteria (col. 16, lines 17-23). A user may define amount of network bandwidth available for the data replication process (col. 16, lines 26-30). For example, if the user network connection is congested, the user may choose to slow down data transfer by the computer network remote data mirroring system 10 during peak hours (e.g., 8:00 AM to 5:00 PM) and then remove the restriction after hours (col. 16, lines 45-49). As another example of network bandwidth throttling (FIG. 10),

the first two throttles deal with maintaining usage of the network 20 below a certain point. Note that "sleep" is incremented by 15,000 microseconds if usage exceeds 200 KB per second. If network usage continues to increase and exceeds 300 KB per second, "sleep" is incremented by 5,000 microseconds every time the throttle evaluates true. The remaining throttles focus on maintaining network usage. If usage begins to decline, "sleep" is decremented continuously until it reaches zero (col. 16, lines 53-63). **Wahl** simply does not involve any disk array device comprising a channel adapter, a disk adapter and a cache such that **Wahl** does not transfer data from any logical system partitions of the disk array device to an external device as recited in claims 1 and 12-14. In addition, **Wahl**'s bandwidth throttling controls data transmission processing by indefinite slowing down processing or indefinite sleeping processing in response to the traffic congestion such that a data transfer request is delayed for an indefinite periods of time between a primary site and a remote/secondary site, rather than just be delayed for a specified preset time from the logical system partitions of the disk array device to the external device. As such, **Wahl** does not "limit data transfer by *delaying* the response to a data write request from said host device by *a specified preset time* when said data transfer amount exceeds said specified value" as recited in claims 1 and 12-14.

U.S. patent 6,625,623 B1 to **Midgley** et al. is assigned to LiveVault Corporation and is entitled "Systems and Methods For Backing Up Data Files." **Midgley** continuous back up of data stored on a computer network (Fig. 1). To guard against losing the data stored on a network 10, **Midgley**'s network 10 includes a backup server 12, a cache memory 16, a long term data storage device 14, and a plurality of agent processes 30, each agent process being located on one of the servers 18, 20 and 22 containing information that will be replicated by the backup data storage system (col. 7, lines 46-51). The back up server 12 may provide a bandwidth control process 44 which may be located on the data servers 18, 20, 22. The user may employ this process 44 to set a network consumption limit for each backup policy and restore operation. When setting this option, the user may select the bandwidth that is available between the source and backup systems, and specify a consumption limit to be allocated to the synchronization and/or dynamic replication processes. If multiple network links are available between the systems, the user may specify the slowest link. Further, the bandwidth control process 44 may include a process for determining, either dynamically, or historically, the available network resources, including network bandwidth and buffer availability, for a given time (col. 19, lines 25-46). Once the consumption limit is set, the bandwidth control process 44 may throttle the bandwidth usage of the agents 30, synchronization replication process 40

or any replication process by limiting the amount of data to be placed on the network 10 per unit of time. To this end, the bandwidth control process 44 may calculate the bandwidth usage limit based on the maximum percentage of bandwidth the user selected for the operation and the type of network specified. Optionally, the user may vary the network bandwidth consumption for a particular policy over the course of a week. Thus a user could choose to limit consumption during the working hours and allow unlimited consumption at other times (col. 19, lines 53-65). To control the bandwidth employed by the system 10, in one practice the bandwidth control process 44, for each policy set by the user, calculates a transmit window which is a theoretical time to transmit the packet plus a delay time between each packet. At runtime, the actual time (T1-T0) to transmit and the transmit window (P) may be used to determine the length of the delay (col. 20, lines 20-32). This algorithm allows the process 44 to minimize, or substantially minimize, network overhead costs by keeping the packet size sufficiently large and increasing the time delay for the low percentage, low capacity cases (col. 20, lines 36-39). **Midgley** simply does not involve any disk array device comprising a channel adapter, a disk adapter and a cache such that **Midgley** does not transfer data from any logical system partitions of the disk array device to an external device as recited in claims 1 and 12-14. In addition, **Midgley**'s bandwidth throttling controls data transmission processing by indefinite delay times in response to the traffic congestion such that a data transfer request is delayed for an indefinite periods of time between a primary site and a remote/secondary site, rather than just be delayed for a specified preset time from the logical system partitions of the disk array device to the external device. As such, **Midgley** does not "limit data transfer by *delaying* the response to a data write request from said host device by *a specified preset time* when said data transfer amount exceeds said specified value" as recited in claims 1 and 12-14.

U.S. Patent App. Pub. No. 2003/0061362 A1 of **Qiu** et al. is entitled "Systems and Methods for Resource Management in Information Storage Environments." **Qiu**'s dynamics measurement-based I/O admission control is enabled by monitoring the workload and the storage device utilization during system run-time, and accepting or rejecting new I/O requests based on run-time knowledge of the workload ([0045]-[0046]). A storage management processing engine 105 may include an I/O manager 140 that may receive requests, e.g., from a file subsystem, for information or data contained in storage devices 110. The I/O manager 140 may be provided with access to I/O characteristic information, such as the estimated average access delay, etc. ([0051]). Storage devices may be partitioned into groups on the basis of one

or more characteristics of resources ([0047]). **Qiu** simply does not involve any disk array device comprising a channel adapter, a disk adapter and a cache, and communicating with an external device such that **Qiu** does not transfer data from any logical system partitions of the disk array device to the external device as recited in claims 1 and 12-14. In addition, **Qiu**'s dynamics measurement-based I/O admission control either accepts or rejects a new I/O request based on run-time knowledge of the workload without specifying what happen after rejection, rather than just delays the request for a specified preset time and finally transferred data from the logical system partitions of the disk array device to the external device. As such, **Qiu** does not "limit data transfer by *delaying* the response to a data write request from said host device by *a specified preset time* when said data transfer amount exceeds said specified value" as recited in claims 1 and 12-14.

U.S. Patent App. Pub. No. 2004/0010605 A1 of **Furukawa** et al. is entitled "Storage Device Band Control Apparatus, Method, and Program." **Furukawa**'s network repeater device 1101 (Fig. 2) relays communication between a network 1311 and a network 1321, and realizing band guarantee in communication between a host terminal 1401 and a network connection type storage 1201 ([0024]). The network repeater 1101 may be a router or switch ([0024]). A communication packet band monitoring block 1121 and a band control communication execution block 1131 in the network repeater device 1101 ([0031]; Fig. 2) realize the band guarantee control function of the communication relaying from the network 1311 to the network 1321 ([0053]). The communication packet band monitoring block 1121 monitors the classified packets in accordance with band control information such as a predetermined traffic and packet processing priority ([0054]). The band control communication execution block 1131 controls packet transmission processing by queue control processing and scheduler processing, and if necessary, discards packets exceeding the requested processing ([0054]). **Furukawa** simply does not involve any disk array device comprising a channel adapter, a disk adapter and a cache, and communicating with an external device such that **Furukawa** does not transfer data from any logical system partitions of the disk array device to the external device as recited in claims 1 and 12-14. In addition, **Furukawa**'s band control communication execution block 1131 controls packet transmission processing by queue control processing, scheduler processing, and optionally discarding processing such that some packets may be expedited while the others may be delayed for indefinite periods of time or simply discarded thereby never being transferred between two networks 1311, 1321, rather than just be delayed for a specified preset time and finally

transferred data from the logical system partitions of the disk array device to the external device. As such, **Furukawa** does not "limit data transfer by *delaying* the response to a data write request from said host device by *a specified preset time* when said data transfer amount exceeds said specified value" as recited in claims 1 and 12-14.

U.S. Patent App. Pub. No. 2004/0181594 A1 of **Suleiman** is assigned to Sun Microsystems, Inc. and entitled "Methods for Assigning Performance Specifications to a Storage Virtual Channel." **Suleiman**'s storage resource 201 (Fig. 2) is in communication with a storage area network 101 and an array of disks 217 ([0030]). The storage resource 201 is comprised of port interface controllers 205, disk interface controllers 219, and a cache subsystem 213 ([0030]). The total bandwidth of the storage resource 201 is partitioned into storage virtual channels (SVCs) ([0035]). Each SVC may be assigned to internal entities, such as a port of the storage resource or a logical unit number (LUN) of the storage resource 201 ([0037]). Ports and LUNs may be dedicated to a single SVC ([0039]). An SVC may be assigned to serve a single client, and its bandwidth may be afforded to that client ([0040]-[0041], [0043]). Each SVC is defined in terms of bandwidth parameters, and is controlled in terms of throughput and response time ([0044]). Various SVCs may limit their clients to a maximum storage resource bandwidth ([0046]). Each SVC is assigned a separate IO queue, where all commands received through a given SVC will be stacked in a given queue. Each queue then is weighted based on the SVC specifications of throughput and response time. In this manner, commands can be scheduled for processing from the various queues in a sequence that preserves the storage resource bandwidth guaranteed by various SVCs to their respective clients ([0051]). A separate cache corresponding to each scheduling queue may also be configured ([0052]). However, **Suleiman** merely weights the importance of each commend and schedules their execution accordingly. As a result, some commends may be expedited while the others may be delayed for indefinite periods of time, rather than any specified preset time. As such, **Suleiman** does not "limit data transfer by *delaying* the response to a data write request from said host device by *a specified preset time* when said data transfer amount exceeds said specified value" as recited in claims 1 and 12-14.

Conclusion

Based on the results of the comprehensive prior art search as discussed above, Applicants contend that the disk array device as recited in independent claims 1 and 12, the remote copying control method for the disk array device as recited in claim 13, and the control

method for the disk array device as recited in claim 14 especially the feature of "limit data transfer by *delaying* the response to a data write request from said host device by *a specified preset time* when said data transfer amount exceeds said specified value" as recited in claims 1 and 12-14 is patentably distinct from the cited prior art references.

In particular, the disk array device 10 (for example, the embodiment shown in Figs. 1 & 8; pp. 13-18, 31-35), comprising: a channel adapter 20 connected to a host device 1 and an external device 5 via a communications port for controlling the exchange of data with the host device 1 and said external device 5; a disk adapter 50 for controlling the exchange of data with a memory device 60; a cache memory 30 used by said channel adapter 20 and said disk adapter 50; one or more logical system partitions SPLRs (p. 14, line 22) which are constructed by logically dividing resources provided by said channel adapter 20, said disk adapter 50, said memory device 60 and said cache memory 30; a transfer amount detection part 251 (Fig. 8; p. 33, last two paragraphs) which detects the amount of data transferred to said external device 5 from said logical system partitions SPLRs for each of said logical system partitions SPLRs; and a data transfer control part 241 (p. 33, last paragraph) which compares a specified value that is preset for each of said logical system partitions SPLRs and the data transfer amount detected by said transfer amount detection part 251, and performs band control that limits the transfer of data from said logical system partitions SPLRs to said external device 5 in cases where the data transfer amount exceeds said specified value. The data transfer control part 241 limits data transfer by **delaying** the response to a data write request from said host device 1 **by a specified preset time** when said data transfer amount exceeds said specified value(p. 33, last paragraph).

As recited in claim 12 (for example, the embodiment shown in Figs. 1 & 8), the invention is directed to a disk array device which includes all the elements of the disk array device 10 as recited in claim 1, wherein channel adapter comprises: a data receiving part 210 for receiving data from said host device 1; a cache control part 220 for storing the received data in a specified region of said cache memory 30; a data acquisition part for acquiring data to be transferred from said cache memory 30 to said external device 5; a transfer processing part 250 for transferring the data acquired by said data acquisition part to said external device 5; the transfer amount detection part 251 of claim 1;a first data transfer control part 241 for comparing a specified value that is preset for each of said logical system partitions SPLRs with the data amount detected by said transfer amount detection part 251; and a second data transfer control part 241 for limiting the transfer of data from said logical system partitions

SPLRs to said external device 5 by **delaying** the response to a data write request from said host device 1 **by a preset specified time** when it is judged by said first data transfer control part 241 that said data transfer amount exceeds said specified value.

As recited in claim 13 (for example, the embodiment described on pages 29 +), the invention is directed to a remote copying control method for the disk array device recited in claim 1, comprising the steps of: judging whether or not remote copying is to be performed from said logical system partitions SPLRs to said external disk array device 5; specifying a logical system partition SPLR, from said logical system partitions SPLRs, for which remote copying is to be performed when it is judged that remote copying is to be performed; detecting the amount of data transferred from said specified logical system partition SPLR to said external disk array device 5; comparing the maximum transfer amount that is preset for said specified logical system partition SPLR with said detected data transfer amount; limiting the data transfer from said specified logical system partition SPLR to said external disk array device 5 by **delaying** the response to a data write request from said host device **by a preset specified time** when it is judged that said data transfer amount exceeds said maximum transfer amount; and performing data transfer from said specified logical system partition SPLR to said external disk array device 5 without any limitation when it is judged that said data transfer amount is equal to or less than said maximum transfer amount.

As recited in claim 14 (for example, the embodiment shown in Fig. 10), the invention is directed to a control method for the disk array device recited in claim 1, comprising the steps of: detecting the amount of data transferred from said logical system partitions SPLRs to said external device 5 for each of said logical system partitions SPLRs; comparing a specified value that is preset for each of said logical system partitions SPLRs with said detected data transfer amount; and limiting the transfer of data from said logical system partitions SPLRs to said external device 5 by **delaying** the response to a data write request from said host device 5 **by a preset specified time** when it is judged that said data transfer amount exceeds said specified value.

In view of all the above, clear and distinct differences as discussed exist between the present invention as now claimed and the prior art references, Applicant respectfully contends that the prior art references cannot anticipate the present invention or render the present invention obvious. Rather, the present invention as a whole is distinguishable, and thereby allowable over the prior art.

Favorable consideration of this application is respectfully solicited. Should there be any outstanding issues requiring discussion that would further the prosecution and allowance of the above-captioned application, the Examiner is invited to contact the Applicant's undersigned representative at the address and telephone number indicated below.

Respectfully submitted,

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